Industry Canada Industrie Canada

SMSE-012-11
August 2011

Spectrum Management and Telecommunications

Consultation on a Policy and Technical Framework for the Use of Non-Broadcasting Applications in the Television Broadcasting Bands Below 698 MHz

Aussi disponible en français

Canada

Contents

1. Intent

Through the release of this paper, Industry Canada is hereby initiating a consultation as announced in *Canada Gazette* notice SMSE-012-11, *Consultation on a Policy and Technical Framework for the Use of Non-Broadcasting Applications in the Television Broadcasting Bands Below 698 MHz*.

Industry Canada is considering whether to introduce a new wireless telecommunications application into the television (TV) broadcasting bands using TV white spaces. TV white space refers to portions of the TV broadcast spectrum that are unassigned so as to prevent interference between broadcast stations or remain unassigned due to limited demand (usually for TV stations in smaller markets).

This portion of the spectrum is also used by other devices and, as such, creates a complex sharing situation where new approaches are required, including the use of databases that ensure that TV white space devices use frequencies in a manner that does not cause interference to nearby broadcast stations.

Comments are sought on all aspects of the policy and technical framework, including the:

1. possible introduction of licence-exempt TV band white space devices;
2. possible changes to the policy and regulatory framework for licensed remote rural broadband systems (RRBS); and
3. possible changes to the policy and regulatory framework for licensed low-power apparatus (LPA), such as wireless microphones.

2. Policy Objectives

The Minister of Industry, through the *Department of Industry Act*, the *Radiocommunication Act* and the *Radiocommunication Regulations*, with due regard to the objectives of the *Telecommunications Act*, is responsible for spectrum management in Canada. As such, the Minister is responsible for developing national policies for spectrum utilization and ensuring effective management of the radio frequency spectrum resource.

One of the objectives of these policies is to ensure that Canadian consumers, businesses and public institutions benefit from the introduction of new, advanced and affordable wireless telecommunications services in all regions of the country. In pursuing this objective, Industry Canada has worked to encourage innovation and investment, which can lead to lower prices, better services and more choice for Canadian consumers, businesses and public institutions.

The goal of the proposals presented in this document is to develop a policy and technical framework to make additional spectrum available for licence-exempt applications while taking into consideration the impact on existing users of the spectrum. This is consistent with the objective of the *Spectrum Policy Framework for Canada* to maximize the economic and social benefits that Canadians derive from the use of the radio frequency spectrum.

In the 2010 Digital Economy Consultation, under the pillar of *Building a World-Class Digital Infrastructure*, access to spectrum was identified as one of the challenges facing Canada. By issuing this consultation paper, the Department is delivering on this commitment.

3. Abbreviations

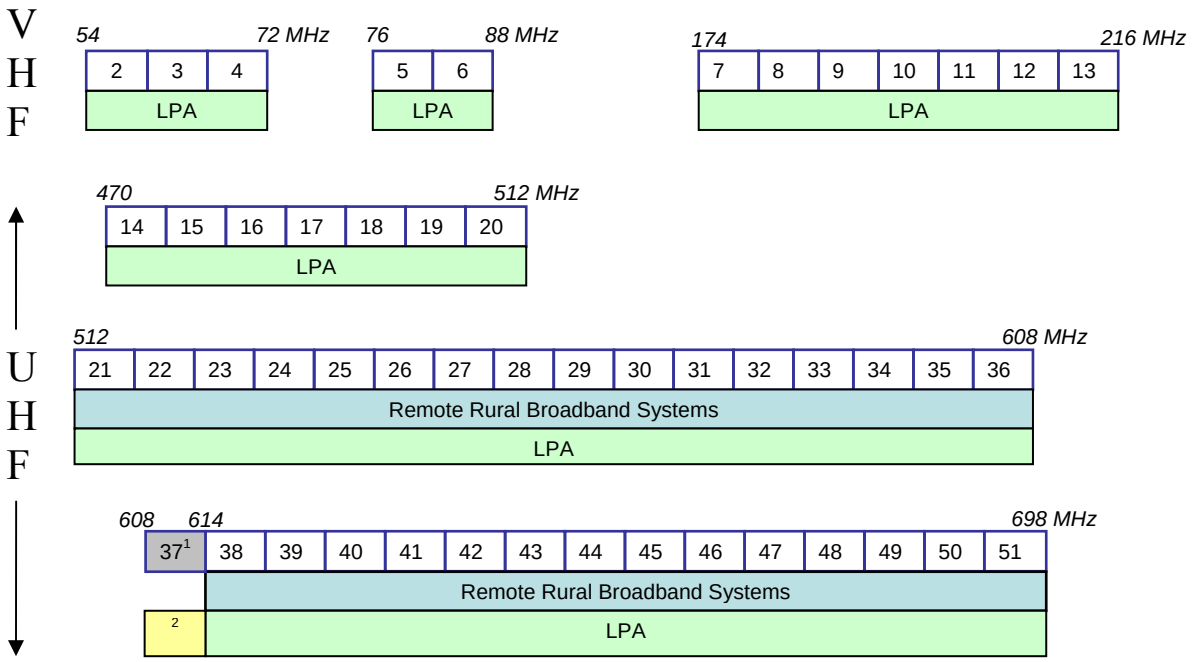
The following abbreviations are used in this document.

BAS	broadcast auxiliary services
CRTC	Canadian Radio-television and Telecommunications Commission
dBm	decibels relative to one milliwatt (0 dBm = -30 dBW)
dBµ	decibels relative to one microvolt per metre
dBW	decibels relative to one watt (0 dBW = 30 dBm)
DTV	digital television
e.i.r.p.	equivalent isotropically radiated power
FCC	U.S. Federal Communications Commission
GHz	gigahertz (1 GHz = 10^9 hertz or a frequency of one billion cycles per second)
GPS	global positioning system
LPA	low-power apparatus (e.g. wireless microphones)
MHz	megahertz (1 MHz = 10^6 hertz or a frequency of one million cycles per second)
RRBS	remote rural broadband systems
Wi-Fi	Wireless Fidelity, an industry technical standard for wireless networking

4. Current Spectrum Use in TV Broadcasting Bands Below 698 MHz

For reference, the following diagram shows the current Canadian spectrum use in TV broadcast spectrum below 698 MHz.

Figure 4-1: Frequency Ranges Under Consideration



Note 1: TV channel 37 is allocated to the radio astronomy service, and is not available for broadcasting or RRBS.
Note 2: TV channel 37 may also be used for wireless medical telemetry.

5. Background

5.1 United States

Television broadcasting bands in the United States have traditionally been shared with other radiocommunication applications, including wireless microphones, broadcast auxiliary services (BAS) and cable television distribution. In addition, footnote NG 66 of the U.S. *Table of Frequency Allocations*[1] specifies that portions of the frequency band 470-512 MHz are available for non-broadcasting applications, including one to three TV channels in 13 large U.S. cities[2] for land mobile and public safety use.

[1] See http://www.fcc.gov/oet/spectrum/.

[2] Boston, MA-Northwestern IN, Chicago, IL, Cleveland, OH, Dallas-Forth Worth, TX, Detroit, MI, Houston, TX, Los Angeles, CA, Miami, FL, New York, NY-Northeastern NJ, Philadelphia, PA, Pittsburgh, PA, San-Fransisco-Oakland, CA, and Washington, DC-MD-VA.

In the United States, the transition to DTV was completed on June 12, 2009, at which time previously auctioned frequencies above 698 MHz became available for commercial and public safety mobile communications. In the spectrum below 698 MHz, wireless microphones, BAS and other services that have traditionally shared spectrum with TV will continue to operate. In addition, the U.S. Federal Communications Commission (FCC) has been very interested in the potential for opportunistic access by unlicensed devices, such as so-called "white space" devices.

The concept of white spaces was first raised in the 2002 U.S. Spectrum Policy Task Force report. In 2004, the Government of the United States first discussed applying the concept of white spaces specifically in the context of the TV bands. The concept of TV white spaces is described in detail in Section 6 of this document.

The FCC issued its final rules for the use of TV white spaces in September 2010.[3] In January 2011, the FCC designated nine companies that will be permitted to provide the database services required for use by white space devices[4] and on July 29, 2011, conditionally designated a 10th company[5] as a database administrator. The FCC decision-making process related to white space devices is now complete, and it is anticipated that such products will first be available on the U.S. market in late 2011 or early 2012. The detailed U.S. rules for TV white space devices are contained in Part 15.701 of Title 47 of the U.S. *Code of Federal Regulations*.

Included in the FCC's September 2010 decision were provisions to reserve two vacant TV channels across the United States, although not necessarily the same channels in each area, for the use of wireless microphones and other low-power auxiliary service devices.

In March 2010, the U.S. National Broadband Plan was published. The plan includes a goal to make 500 MHz of radio spectrum available for mobile broadband use in the frequency range from 225 MHz to 3.7 GHz within 10 years. Of this amount, 300 MHz is to be made available for mobile broadband use within five years. This would include up to 120 MHz of TV broadcast spectrum below 698 MHz, which would be made available through a combination of a proposed incentive auctions that would compensate U.S. TV broadcasters who agreed to cease over-the-air operation. Measures would be taken to rearrange the channel assignments for remaining DTV broadcasters so that they would fit in the remaining spectrum. If this plan goes ahead, it will result in a reduction in spectrum available in the United States for white space applications in TV bands.

5.2 United Kingdom

In the United Kingdom, Ofcom initiated a consultation on November 9, 2010, containing proposals on how to successfully launch TV white space technology and how new devices can be made available to

---

[3] See FCC 10-174, which is available at http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0923/FCC-10-174A1.pdf.

[4] See DA 11-131, which is available at http://www.fcc.gov/Daily_Releases/Daily_Business/2011/db0126/DA-11-131A1.pdf.

[5] See DA 11-1291, which is available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2011/db0729/DA-11-1291A1.pdf.

consumers without the need for a licence.[6] Comments on this consultation were due on December 7, 2010, but final rules are still pending. Ofcom has indicated that it expects that this will be the last consultation needed before adopting rules for white space devices.

Ofcom's proposed rules for TV white space devices are broadly similar to those of the U.S. FCC in that they are both proposing that these devices operate on a licence-exempt basis, using database systems to protect other spectrum users from interference. The main differences between the U.S. and U.K. approaches to TV white space devices are that the United Kingdom has provided for greater flexibility in the how its TV white space devices meet the criteria for protection of TV broadcast receivers from interference. For example, devices can trade off power against out-of-band emissions or power against separation distance. The resulting complexity will require correspondingly greater technical sophistication in the databases used in the United Kingdom. Full details are provided in Ofcom's consultation paper, which is cited above.

5.3 Canada

Like other countries, Canada is looking at ways to improve access to spectrum for new applications. Canada is interested in developing new policies to provide access to spectrum that in the past would have been difficult to use. For example, following the 2003 World Radiocommunication Conference, Canada allowed licence-exempt radio local area networks (RLANs) to operate in the 5 GHz band by making use of technical measures (e.g. dynamic frequency assignment) to share spectrum with existing radar systems.

Over-the-air broadcasting has long been a key vehicle for delivering TV programming to Canadians. However, development in the United States and the United Kingdom has shown the potential to accommodate additional uses in this spectrum.

Canada, again like many other countries, is moving toward a digital standard for the provision of over-the-air TV broadcasting. The CRTC has issued three notices on this matter: the first, Broadcasting Public Notice CRTC 2007-53,[7] set the date of August 31, 2011, after which Canadian TV broadcasting licensees would be authorized to broadcast only digital over-the-air signals, with the exceptions of TV stations in northern and remote communities. During the period leading up to this date, Industry Canada made allowances for simultaneous analog and digital TV (DTV) transmissions by allotting an additional digital channel to each existing analog TV broadcasting station. Following the transition to DTV, these extra channels should no longer be needed.

The CRTC modified its decision in July 2009 through Broadcasting Regulatory Policy CRTC 2009-406.[8] This decision limited the requirement to convert to DTV to only certain mandatory markets, which include the National Capital Region, provincial and territorial capitals, markets served by more than one originating station and markets with a population greater than 300,000 people. In a further

---

6 See *Ofcom: Implementing Geolocation*, which is available at http://stakeholders.ofcom.org.uk/consultations/geolocation/?a=0.

7 See http://www.crtc.gc.ca/Eng/archive/2007/pb2007-53.htm.

8 See http://www.crtc.gc.ca/eng/archive/2009/2009-406.htm.

modification on March 14, 2011, the CRTC released Broadcasting Regulatory Policy CRTC 2011-184,[9] which removed territorial capitals as mandatory markets.

Based on these decisions, the CRTC has identified the following markets where it will be mandatory for existing TV broadcasters to transition to DTV:

- British Columbia: Vancouver, Victoria
- Alberta: Calgary, Edmonton, Lethbridge, Lloydminster
- Saskatchewan: Regina, Saskatoon
- Manitoba: Winnipeg
- Ontario: Toronto (includes Barrie and Hamilton), London, Windsor, Kitchener, Thunder Bay
- Quebec: Montréal, Québec, Trois-Rivières, Sherbrooke, Rivière-du-Loup, Saguenay, Rouyn-Noranda/Val d'Or
- New Brunswick: Saint John, Moncton, Fredericton
- Nova Scotia: Halifax
- Prince Edward Island: Charlottetown
- Newfoundland and Labrador: St. John's
- National Capital Region (Ottawa-Gatineau)

Using spectrum that has been made available due to the transition from analog to digital TV, radio spectrum above 698 MHz is now being made available for use by commercial entities and public safety agencies for mobile wireless telecommunications. This is currently the subject of a public consultation entitled *Consultation on a Policy and Technical Framework for the 700 MHz Band and Aspects Related to Commercial Mobile Spectrum,*[10] which covers the use of the spectrum above 698 MHz.

TV broadcasting spectrum below 698 MHz is already shared with licensed LPA such as wireless microphones.[11] In January 2010, Industry Canada issued a Spectrum Advisory Bulletin (SAB-001-10),[12] which restricted the licensing and certification of LPA in the band 698-806 MHz.

In addition, in June 2006, Industry Canada established rules for the use of licensed subscriber-based broadband Internet systems in remote rural areas on TV channels 21 to 51 (512-698 MHz) except channel 37.[13] These systems, called RRBS, are unique to Canada and are established on a no-protection, no-interference basis with respect to all TV broadcast stations, including low-power and very low-power TV (refer to Radio Systems Policy RP-06[14]).

---

9 See http://www.crtc.gc.ca/eng/archive/2011/2011-184.htm.

10 See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09949.html.

11 Low-power apparatus consists of wireless microphones, cue and control communications, synchronization of video camera signals and video cameras.

12 SAB-001-10, *Low-power Licensed Radiocommunication Devices, Including Wireless Microphones, in the Band 698-806 MHz*, is available at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09777.html.

13 Channel 37 is allocated to the radio astronomy service, and is not available for broadcasting or RRBS.

14 See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08664.html.

RRBS licences are authorized by Industry Canada, on a case-by-case basis, to make use of radio spectrum that is currently unallotted and unassigned to TV broadcasters provided that:

- the RRBS be located at sufficient distance from major population centres, TV broadcasting facilities and their service contours so as not to cause them interference; and

- the RRBS not constrain the provision of current and future TV broadcasting services.

Although TV broadcasting bands are already shared with LPA and RRBS, many TV channels in many locations remain unassigned and unused by LPA, RRBS or broadcasting. The remainder of this paper considers how this unused spectrum could be put to use.

6. Introduction of TV White Space Devices in Canada

White space devices are designed to operate using unassigned TV channels and without interfering with licensed broadcasters or other authorized wireless telecommunications licensees. These devices would be exempted from requiring a licence and would operate on a no-protection, no-interference basis with respect to licensed radio systems. However, these devices would need to be certified under the applicable department's technical standard.

If Industry Canada authorizes the use of white space, it is anticipated that these devices would be initially targeted at the mass consumer market. Consumers could potentially benefit in three ways:

- from the availability of consumer Wi-Fi devices with significantly improved range;
- from improved access to the Internet service resulting from availability of lower cost wireless broadband equipment; and
- from potential future availability of innovative new products and services.

Potential applications include:

- last-mile Internet service to individual homes by a wireless Internet service provider in a manner similar to services provided through RRBS; and
- local area networking within a home or office using consumer-owned equipment (this could be used, for example, to redistribute Internet service that has already been brought to the home or office by other means).

Beyond the above applications, it has been argued in the various proceedings in the United States and the United Kingdom that allowing for the use of white spaces on a licence-exempt basis has the potential to foster innovation and other applications that may result from the development of associated technologies. In particular, the use of white space may facilitate the development of dynamic spectrum access techniques, which is a key component in making more spectrum available through improved spectrum sharing.

6-1 Comments are sought on the benefits that could be expected from making white space available in Canada.

The introduction of new radio technologies in Canada requires that Industry Canada first develop appropriate technical standards and specify appropriate operating parameters to ensure that other users of the radio spectrum environment are adequately protected from potential radio interference. The hands-off nature of licence-exemption traditionally meant that Industry Canada had to rely primarily upon compliance with technical standards at the time of certification, rather than specific parameters associated at the time of operation, as a means of preventing harmful interference to other spectrum users. For these reasons, technical standards established for equipment certification have had to be developed using conservative assumptions regarding interference potential. Also, once a licence-exempt product had been sold in significant numbers, it would have been difficult to take corrective action en masse should interference have occurred, or if non-compliance with technical standards were revealed through subsequent market surveillance.

One important innovation of white space devices is the use of registration databases, which allow for real time control of interference. Because much of the technical parameters that limit operation of white space devices reside in such databases, changes to technical and operating requirements can be made quite quickly, simply by modifying how the database functions. For example, interference protection criteria could be tightened or relaxed, as required, as experience is gained. In addition, operation of malfunctioning equipment could be immediately restricted until it is possible to make necessary repairs.

The reactive capability provided by these database functionalities could allow Industry Canada to take a more timely, flexible approach to the development of upfront technical rules that would still ensure protection of other radio systems from interference. This, in turn, could lead to improved access to a finite supply of radio spectrum.

6-2 Comments are sought on the benefits of the above-mentioned innovation to manage interference.

As was noted earlier, the United States is seeking additional spectrum for mobile broadband use in what are currently TV broadcasting bands. This has the potential to reduce the amount of spectrum available for white space devices in the United States. The potential impact of these developments on TV broadcasting in Canada is outside the scope of this paper. However, regardless of the amount of spectrum that may be available for white space devices, Industry Canada concludes that the potential innovation related to the management of interference discussed above remains unchanged.

6.1 Use of Spectrum Sensing and Databases

There are two general approaches that can be used by white space devices to provide interference protection for existing licensees in the TV bands: spectrum sensing and use of geographic TV band databases.

Spectrum sensing is defined as the capability of detecting and avoiding signals from TV broadcasting stations and LPA that exceed a certain threshold within defined receiver bandwidths. Thus, a white space device would monitor the radio frequency band desired for operation and sense whether the spectrum is currently being used. If, based on the detection threshold, the spectrum was not being used, the white space device could then operate. Monitoring would be required on an ongoing basis to

determine if a TV broadcast, LPA or RRBS transmission begins. If such a signal is detected, the white space device would be required to cease transmission.

To date, there has been significant investment in research and development of spectrum sensing. Spectrum sensing is a very flexible approach, but is also subject to a trade-off between the ability to detect weak signals and susceptibility to false positives in detecting protected systems. Sensing devices require the use of a beacon or a hybrid database approach to protect receive-only stations and may not be able to detect a nearby protected station that is communicating with another station located much further away (the so-called "hidden node" problem). This is a specific area of research that is ongoing.

As an alternative to sensing, databases can be used to provide protection to other radio services. With this approach, a list of protected spectrum users is maintained in one or more central databases. White space devices would automatically access these databases to determine what spectrum, if any, is available at its location. If spectrum is available, the devices would begin to operate in the channel specified by the database. White space devices would be required to periodically reconfirm what spectrum is available in case of changes or if the device has moved.

The use of databases requires the establishment of infrastructure before the devices can be used. This approach cannot provide protection to other spectrum users unless they have been explicitly identified in advance. On the other hand, database systems provide the capability to respond to problems with licence-exempt equipment after it is already in the field without the need for a consumer recall. A number of databases that are capable of providing adequate interference protection to incumbents are already rolling out in the United States. Databases could provide a testing ground for future spectrum sensing. Hybrid approaches, using elements of both sensing and databases, are a possible intermediate step.

Based on the status of development of these technologies, Industry Canada proposes to focus initially on the use of geographic databases to ensure interference protection to TV stations from white space devices. This would be consistent with the approaches taken in the United States and the United Kingdom. Spectrum sensing is expected to continue to develop and would therefore be permitted once this technology has matured sufficiently. At that time, technical rules regarding spectrum sensing devices will be developed.

6-3 Comments are sought on the above proposed approach of setting technical standards now with respect to database dependent systems, and developing standards with respect to spectrum sensing devices when that technology has matured.

6.2 Establishment of Databases of Protected Canadian Systems

In order to protect licensed and other authorized radio systems currently operating in the TV broadcasting bands, Canadian databases could be developed where white space devices would register their intended areas of operation and obtain a list of frequencies available for use at those locations. Such registration would require that white space devices provide their geographic coordinates to one or more databases. Such databases could provide further intelligence by adapting the provided list of available frequencies to the technical parameters of a particular white space device.

If white space devices are introduced in Canada, Industry Canada proposes that the private sector develop and operate the Canadian databases of protected systems. This will allow interested stakeholders to develop and maintain databases that will be responsive to their needs. Industry Canada would limit itself to the development of criteria related to the protection of other radio systems in the band from harmful interference.

Industry Canada is proposing that, as a technical standard, each white space device be capable of being registered with and operated in concordance with a central database similar to the databases that have been developed in the United States under FCC rules. All Canadian users would be taken into account and multiple databases would be possible. These databases could be located in Canada or elsewhere. Database operation would be open to any private sector organization. Industry Canada would not regulate the development, management or internal operation of such databases or the exchange of data between different database administrators, and would not establish requirements for open access, security or reliability.

The performance requirements of white space devices as they pertain to spectrum would be dealt with through certification. This certification process would include the assessment of the system comprising the white space device and one or more databases rather than only the white space device on its own. Although the Department would not regulate the operation of the databases, it would have to ensure that each device ties to a database and includes a capability, in the event of interference problems, to restrict its operation after it has been placed into use. The Department would also establish maximum time frames between the entry of new station information in its licensing databases and these stations being extended protection from white space devices.

To meet these requirements, each white space device will need to provide data, including its location, to a database. This data would be retained for a period of time in order to provide a capability for after-the fact data audits of suspected interference cases. In principle, this data would not be associated with any particular individual given that there is no direct business relationship between the user of a white space device and a database operator. However, it is possible that a database operator could be able to link a white space device to an individual using personal data obtained through other means, for example, if the operator has an existing relationship with that individual. Although this is not likely to be common practice, database operators should be aware that the collection, use and disclosure of personal information in the course of a commercial activity, including transfer to a third party for processing, are governed by Part 1 of the *Personal Information Protection and Electronic Documents Act*[15] or substantially similar provincial legislation, where applicable.

6-4 Comments are sought on these proposed provisions related to database performance and operation. Would these provisions provide sufficient capability to respond to interference cases or other problems that might occur once the white space devices are in use? Are there any additional provisions that Industry Canada should adopt?

[15] See http://laws-lois.justice.gc.ca/eng/acts/P-8.6/.

6.3 Technical Provisions

The following section outlines proposed technical provisions for white space devices in Canada.

6.3.1 Types of White Space Devices

For the purposes of these technical provisions, white space devices fall into the following categories:

Fixed white space device: A white space device that transmits and/or receives radiocommunication signals at a specified fixed location. The fixed device selects radio frequency channels for operation from a list of available channels provided by a TV band database.

Mobile white space device: A white space device that transmits and/or receives radiocommunication signals while in motion or at unspecified fixed points.

- **Mode I mobile white space device:** A mobile white space device that does not use an internal geo-location capability and does not directly access a TV band database to obtain a list of available radio frequency channels. Mode I mobile devices may also be referred to as "slave" devices. A Mode I device must obtain a list of available channels on which it may operate from either a fixed device or a Mode II mobile device. A Mode I device does not initiate a network of white space devices or provide a list of available radio frequency channels to another Mode I device for operation by such a device.

- **Mode II mobile white space device:** A mobile white space device that uses an internal geo-location capability and access to a TV band database for a list of available radio frequency channels. Mode II devices may also be referred to as "master" devices. Access to the database may be through a direct connection to the Internet or through an indirect connection via another fixed or Mode II white space device. A Mode II device may provide its list of available radio frequency channels to another mobile device for operation by that device.

6-5 Comments are sought on the above categories.

6.3.2 Operating Channels

With some restrictions, it is proposed that white space devices be permitted to operate on available channels throughout the TV broadcasting bands below 698 MHz (see Figure 4-1). White space devices would not be permitted to operate on TV channel 37 in order to protect radio astronomy from harmful interference and minimize interference to medical telemetry systems.

Industry Canada notes that white space devices in the United States are subject to additional restrictions on operating channels, depending on whether a fixed or mobile white space device is being used.[16]

[16] For instance, in the United States, mobile white space devices may be limited to operating (transmit or receive) only on available channels above 512 MHz (TV channels 21-36 and 38-51) and operation of fixed white space devices may not be permitted on TV channels 3 and 4 (60-72 MHz) given that those channels are heavily used by consumer electronic devices.

Although Industry Canada anticipates, following any decision, to broadly harmonize with these rules in order to facilitate a common market for equipment with its resulting benefits for equipment cost and availability, detailed rules will be developed regarding available operating channels for different categories of white space devices. The operation of white space devices in Canada would be permitted using Industry Canada's established process, which includes consultation with the Radio Advisory Board of Canada.

6-6 Comments are sought on these proposals.

6.3.3 Technical Parameters

Detailed technical parameters for white space devices have not yet been established. These will be developed following any decision to permit the operation of white space devices in Canada using Industry Canada's established process. It is anticipated that these technical parameters would be broadly harmonized with those of the United States[17] so as to promote a common market for equipment with its resulting benefits for equipment cost and availability.

6-7 Comments are sought on the above proposal to broadly harmonize technical rules with those in the United States. Considering the potential benefits of such harmonization, are there areas where Canada should consider variations from the U.S. technical rules?

It is expected that the technology using white space will continue to improve. As such, the Department expects to revisit and update the technical rules for white space devices as needed to reflect these improvements.

6.4 Protection of TV Broadcasting

If white space devices are introduced in Canada, it will be essential to ensure the protection of all over-the-air TV broadcasting services, including full power, low-power and very low-power TV, as well as receive-only stations that make use of TV broadcast signals such as cable TV head-ends and low-power TV receive sites.

TV broadcasting in Canada is currently in transition from analog to digital. During this period, some broadcasters are simultaneously transmitting analog and DTV signals on separate channels until they can operate fully using digital transmissions. Following the DTV transition, these analog channels will no longer be required. This will increase the spectrum potentially available for white space devices.

There will be continued analog TV broadcasting operations throughout the country. For this reason, protection criteria for both analog and digital TV broadcasting will be developed.

---

[17] For instance, e.i.r.p. limits of 6 dBW for fixed devices and 20 dBm for personal/portable devices (16 dBm within the adjacent channel separation distance) and a requirement to use power control.

Protection of TV broadcasting from harmful interference by white space devices requires a physical separation between the two types of radio systems. Detailed interference protection criteria for white space devices will be developed following any decision to permit the operation of white space devices in Canada using Industry Canada's established process. Separation distances would be defined with regard to the protected service contours of both analog and DTV broadcasting stations. Current TV protected contours are defined in Table 6.1.

Table 6.1: Current TV Protected Contours

Type of TV station[Note 1]	**TV Channel**	**Protected Contour (dBµ)**	**Propagation Curve**[Note 2]
Analog (full and low-power)[Note 3]	Low VHF (channels 2-6)	47	F(50,50)
	High VHF (channels 7-13)	56	F(50,50)
	UHF (channels 14-51)	64	F(50,50)
Digital (full-power)[Note 4]	Low VHF (channels 2-6)	28	F(50,90)
	High VHF (channels 7-13)	36	F(50,90)
	UHF (channels 14-51)	41-20log(615/F) [Notes 5, 6]	F(50,90)
Digital (low-power)[Note 4]	Low VHF (channels 2-6)	43	F(50,90)
	High VHF (channels 7-13)	48	F(50,90)
	UHF (channels 14-51)	51-20log(615/F) [Notes 5, 6]	F(50,90)

Note 1: Protection would be extended to cable TV head-ends and low-power TV receive sites that may be located outside of the protected contour of the TV broadcasting station whose signal it receives.

Note 2: See BPR-10, *Application Procedures and Rules for Digital Television (DTV) Undertakings*, Appendix 6, http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09574.html.

Note 3: See BPR-4, *Application Procedures and Rules for Television Broadcasting Undertakings*, Section C-1.1.17, http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01154.html.

Note 4: See BPR-10, Section B-1.5.

Note 5: F is the centre frequency of the TV channel in megahertz.

Note 6: In the United States, a value of 41 dBµ is used instead of the equation 41-20log(615/F).

In keeping with Industry Canada's proposal to broadly harmonize with the United States, the co-channel and adjacent-channel separation distances relative to the TV protected contours specified in Table 6.2 would form a starting point for discussion of interference protection criteria for TV receivers. In this scenario, there would be no restriction on the operation of white space devices on the second and further adjacent channels to a TV broadcasting station.

Table 6.2: Potential Interference Protection Criteria for TV Receivers

TV White Space Device Characteristics			Required Separation (km) from Analog or DTV Protected Contour	
Type	**maximum e.i.r.p.**	**Antenna Height**	**Co-channel**	**Adjacent-channel**
Mobile (Mode I or II)	16 dBm	not applicable	6.0 km	[Note 1]
	20 dBm	not applicable	6.0 km	0.1 km
Fixed	6 dBW	less than 3 metres	6.0 km	0.1 km
		3 to less than 10 metres	8.0 km	0.1 km
		10 to 30 metres	14.4 km	0.74 km

Note 1: Due to the low potential for interference, mobile white space devices with an e.i.r.p. of 16 dBm or less would be permitted to operate within or outside broadcast coverage areas with no minimum separation distance from the protected contour of a TV broadcast station when using the adjacent channel.

Industry Canada notes that Ofcom has proposed a different approach for interference protection. Rather than specify minimum separation distances, Ofcom has proposed that white space devices in the United Kingdom continuously adjust their transmitter power levels under database control to ensure that TV broadcast interference protection requirements are met. If the Department were to adopt a similar approach, it could provide additional flexibility and increase the amount of spectrum available to white space devices without any increased risk to TV broadcast reception. In this scenario, it is expected that white space devices designed solely for the U.S. market would still be able to operate in Canada, but would not be able to take advantage of this extra flexibility.

6-8 Comments are sought on the interference protection criteria for TV broadcasting operations. Are the provisions in Table 6.2 adequate to ensure the protection of over-the-air TV broadcasting services? Should provision be made for white space devices using power control to have additional flexibility in selecting frequencies, as has been proposed in the United Kingdom?

6.5 Remote Rural Broadband Systems (RRBS)

RRBS are advanced communications systems that provide service in remote rural communities in Canada,[18] using TV channels that are unallotted and unassigned. These systems are evaluated before receiving a licence, to prevent interference to other spectrum users, in particular TV broadcasters. The RRBS are licensed on a no-protection, no-interference basis in relation to the broadcasting service, on condition that they not constrain the provision of existing or future broadcasting services.

The policy decision to allow RRBS in Canada was established in Radio Systems Policy RP-06, *Policy for the Use of 700 MHz Systems for Public Safety Applications and Other Limited Use of Broadcasting*

[18] In the context of RRBS, remote rural areas are defined as areas having fewer than 100,000 people within a 50 km radius.

Spectrum,[19] published in June 2006, which, in turn, was a further refinement to the policy established in accordance with Spectrum Utilization Policy SP 746 MHz, *Mobile Service Allocation Decision and Designation of Spectrum for Public Safety in the Frequency Band 746-806 MHz.*[20]

In March 2010, technical rules for RRBS were finalized and set out in two documents: RSS-196, *Point-to-Multipoint Broadband Equipment Operating in the Bands 512-608 MHz and 614-698 MHz for Rural Remote Broadband Systems (RRBS) (TV Channels 21 to 51)*[21] and SRSP-300.512, *Technical Requirements for Remote Rural Broadband Systems (RRBS) Operating in the Bands 512-608 MHz and 614-698 MHz (TV Channels 21 to 51).*[22]

By spring 2011, Industry Canada had issued 555 licences for RRBS operation to a total of 14 licensees. The current geographic distribution of RRBS licences is:

- 7 in British Columbia;
- 450 in Alberta;
- 56 in Saskatchewan;
- 36 in Ontario;
- 5 in Quebec and
- 1 in Nunavut.

RRBS incorporate base stations and fixed customer premises equipment (CPE). These base stations operate at up to 500 watts e.i.r.p. and are capable of providing service to a radius of 2 to 20 km, depending on the equipment used. Radio licences for RRBS are issued only to radiocommunication service providers. System subscribers are not required to hold individual radio licences provided that the RRBS service provider's base stations are licensed. RRBS licences are issued on a first-come, first-served basis.

These technical rules for RRBS equipment provide for much higher transmitter power levels than would be permitted for white space devices. In addition, no spectrum sensing or database access is required. Protection to other radio services from interference is provided through evaluation during the licensing process. Because of the constraints of the evaluation process, RRBS is limited to fixed operation only.

At this time, there are only two models of certified equipment available for RRBS deployment. However, the technical parameters anticipated for white space devices would be well within the limits currently permitted for RRBS and it is anticipated that white space devices could be readily adapted for operation under the current rules for RRBS.

Although there has been a great deal of interest in RRBS in Canada, there have been some obstacles to their continued success. The small size of the Canadian market and the exclusion of urban customers have limited equipment selection and made it difficult to take advantage of economies of scale.

---

[19] See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08664.html.

[20] See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08250.html.

[21] See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09831.html.

[22] See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09832.html.

Equipment that does not incorporate sensing or database systems to prevent interference to TV reception require, from the part of the licensee, technical sophistication and upfront efforts to prepare for deployment. For these reasons, Industry Canada is seeking feedback on whether it should continue with the status quo for RRBS or take a more hands-off approach while taking advantage of the developments in the area of white space devices.

As an alternative to the status quo, Industry Canada is open to the consideration of a licence-exempt regime for RRBS. In this case, RRBS would be phased out in favour of white space devices. In order to ensure that there is no loss of functionality or coverage compared to existing systems, the technical rules for white space devices would be relaxed (e.g. to allow for increased power), under database control, when they are operating in remote rural areas. In order to ensure protection of TV reception, such devices would be subject to more restrictive protection criteria than those proposed in Section 6.4.

Detailed technical parameters and protection criteria would be developed using Industry Canada's established process. Regardless of any potential changes, Industry Canada proposes to grandfather existing deployed RRBS and to ensure that these systems are provided protection from white space devices for the duration of their licences. New RRBS deployment, as well as the expansion of existing systems, would take place under the new rules.

6-9 Comments are sought on the potential for improvements to the policy and technical framework for RRBS, including the possibility of moving to a licence-exempt regime, leveraging white space technology.

To the extent that licensing of RRBS is continued, these systems would be included in any TV band databases for Canada. The starting point for the development of protection criteria for licensed RRBS would be the current RRBS-to-RRBS coordination criteria set out in Section 9.2 of SRSP-300.512, *Technical Requirements for Remote Rural Broadband Systems (RRBS) Operating in the Bands 512-608 MHz and 614-698 MHz (TV Channels 21 to 51)*.[23] For example, the protection criteria for RRBS could be defined with respect to the nominal service contour of 30.8 dBµV/m at a receive antenna height of 10 m calculated using the F(50,90) propagation curves.

6.6 Low-power Apparatus (LPA)

For many years, Industry Canada has made parts of the FM and TV broadcast bands available for use by LPA. LPA operating in TV broadcasting bands includes devices such as wireless microphones, cue and control communications, and synchronization of video camera signals.

Currently, any LPA operating in Canadian TV broadcasting bands requires a valid radio station licence. Licensing of LPA is available to all applicants who are eligible to hold a radio station licence in Canada (e.g. broadcasters, church organizations and theatre operators who require LPA on a site-specific basis). In most cases, licenses are issued on a site-specific basis; however, licences may also be issued on a nationwide basis to broadcasters, such as when covering news events in the field. LPA licences are currently granted on a no-protection, no-interference basis. Note that, rather than licensing each piece of

[23] See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09832.html#s9_2.

radio apparatus individually, Industry Canada issues a single mobile radio station licence for all microphones associated with an LPA system, and a single land station radio licence for all associated fixed receivers.

In January 2010, Industry Canada issued Spectrum Advisory Bulletin SAB-001-10, which restricted the licensing and certification of LPA in the band 698-806 MHz.[24]

In the case of LPA operating in the TV broadcasting bands below 698 MHz, a radio station licence is required in accordance with the procedures described in CPC-2-1-11, *Low-power Licensed Radiocommunication Devices*.[25] In addition, LPA must be certified pursuant to the criteria outlined in RSS-123, *Licensed Low-Power Radio Apparatus,* before the apparatus can be installed, operated, possessed, manufactured, imported, distributed, leased, offered for sale or sold in Canada.[26] RSS-123 also specifies frequency bands and other technical parameters under which such devices are permitted to operate.

Currently, there are approximately 50 licensees who hold 130 licences for LPA operation in TV broadcasting bands across Canada. However, experience in the United States and Europe suggests that, in many cases, LPA may often be operating without valid authorization. This is likely due to lack of awareness by many consumers that they must obtain a radio station licence before operating the LPA. There has been no evidence of interference problems due to the current use of LPA in the TV broadcasting bands. This suggests that the current authorization regime may pose an unnecessary burden on users of LPA and that changes may be possible to reduce the burden of regulatory compliance on LPA users.

Industry Canada believes that it may be advantageous to identify specific frequency ranges for LPA use and to restrict the operation of licence-exempt LPA to these channels. Because this spectrum would not be shared with white space devices, it would ease sharing between broadcasting and LPA and would allow for rapid LPA deployment without the need to first register such devices.[27] This is the approach being taken in the United States, where the FCC has decided to set aside two TV channels (a total of 12 MHz of spectrum) in each market across that country. If specific frequency ranges are identified in Canada for LPA, Industry Canada would make every effort to harmonize to the extent possible with similar spectrum in the United States and the United Kingdom.

In addition to these benefits, restricting licence-exempt LPA to specific frequency ranges would preserve flexibility if further changes to TV broadcasting spectrum are contemplated in future. For instance, as noted in Section 5.1, the use of the bands below 698 MHz is currently under review in the United States as part of its National Broadband Program. In this context, a dedicated frequency range may minimize future negative impacts to the operation of LPA.

---

[24] SAB-001-10, *Low-power Licensed Radiocommunication Devices, Including Wireless Microphones, in the Band 698-806 MHz*, is available at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09777.html.

[25] See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08883.html.

[26] See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01323.html.

[27] In the United States, the FCC requires a minimum 30-day advance notice before unlicensed devices can be registered for protection.

If specific TV channels are identified, the same channels may not be available in all areas across Canada. This means that it may be necessary to design LPA with enough flexibility to tune throughout all TV broadcasting bands and users would be responsible for ensuring that an appropriate frequency is used. A downside to setting aside spectrum for LPA would be a reduction in spectrum for applications such as white space devices.

Industry Canada is considering the following options for the authorization of LPA in Canada:

1. allow licence-exempt operation of LPA on a no-protection, no-interference basis, but with the option for users to apply for a licence in exchange for interference protection from white space devices;
2. move to a completely licence-exempt regime for LPA where users desiring protection from white space devices can voluntarily register details of their operation in a database, whereas other LPA would operate on a no-protection, no-interference basis;
3. move to a completely licence-exempt regime where all LPA will operate on a no-protection, no-interference basis;
4. phase out separate provisions for LPA and instead provide this functionality using specialized white space devices; and/or
5. continue to require a licence for the use of all LPA, with interference protection from white space devices provided to all licensees.

The protection from white space devices provided to LPA under options 1, 2 and 5 would require that data for protected LPA be included in any TV band databases and that appropriate protection levels be established.

This could restrict the availability of spectrum for white space devices, to provide interference protection to LPA throughout their area of operation, especially considering that many licensees hold nationwide licences (e.g. news crews), or that white space devices are only in use a portion of the time (e.g. religious services, theatres, concerts or sporting events). Because Industry Canada does not collect detailed data on time and location of use, a registration process would be necessary to determine exactly where and when such LPA requires protection.

Industry Canada does not propose to impose any additional restriction on eligibility to apply for a radio licence or to register for protection from white space devices. The decision as to whether protection is needed should be made by users of the LPA depending on their operational requirements.

To the extent that protection from white space devices is provided to LPA, detailed interference protection criteria would be established in consultation with the Radio Advisory Board of Canada following any decision to permit such devices to operate in Canada. It is anticipated that the relevant minimum separation distances would be broadly harmonized with those in the United States[28] and would be based on the geographic coordinates and time-of-use information of LPA whose licensees have chosen to register their stations.

[28] For example, a minimum separation distance of 1 km for fixed white space devices and 400 metres for mobile white space devices.

The advantage of option 3 is the anticipated low regulatory burden for users of LPA. The risk of interference could be mitigated by identifying specific LPA frequencies on which the operation of white space devices would not be permitted.

With respect to option 4, Industry Canada is open to considering whether provisions for LPA in TV broadcasting bands could be phased out over the medium to long term, in favour of white space devices that provide equivalent functionality (e.g. a wireless microphone that uses access to a white space database to determine its operating frequency).

Lastly, option 5 would continue to require that all LPA be licensed, affording interference protection from white space devices. However, should this option be selected, issues would persist regarding associated regulatory burdens for licensees and potential unauthorized LPA operation.

6-10 Should Industry Canada identify specific spectrum for use by LPA? If so, how much should be identified and should the operation of licence-exempt LPA be restricted to this spectrum?

6-11 Comments are sought on the options for the authorization of LPA in Canada. Provide justification for this choice of option.

6-12 If option 1, 2 or 5 is chosen, comments are sought on the proposal to collect "time and location of use" data based on voluntary registration and the proposal that eligibility to register for such protection be open to all users of LPA. Comments are also sought on the appropriate protection criteria to protect LPA from interference from white space devices.

6.7 Other Potential Impacts

6.7.1 Impact to Radio Astronomy

Following any decision to permit the operation of white space devices in Canada, Industry Canada will adopt provisions through its established process, which includes consultation with the Radio Advisory Board of Canada, to protect radio astronomy observations at the Dominion Radio Astrophysical Observatory located in Penticton, British Columbia.[29]

6.7.2 Impact to Adjacent Bands

With the possible introduction of white space devices in Canada, out-of-band emissions criteria would be established with respect to adjacent TV channels, as well as limits that would be applicable for emissions outside of the TV broadcasting bands.

[29] In the United States, white space devices are not permitted to operate within a radius of 2.4 km of a radio astronomy observatory regardless of the frequency in the TV broadcasting bands being used. To minimize adjacent band emissions on channel 37, operation of white space devices on TV channels 36 and 38 (602-608 MHz and 614-620 MHz) is only permitted if no other channel is available.

As previously noted, detailed protection criteria will be established in consultation with the Radio Advisory Board of Canada following any decision to permit the operation of licence-exempt white space devices in Canada. In such a case, it is anticipated that out-of-band emission limits for white space devices would be broadly harmonized with those in the United States.[30] Further, it is anticipated that the limits for emissions outside of the TV broadcasting bands would be based on the general field strength limits specified in Section 7.2.5 of Industry Canada's document entitled RSS-Gen, *General Requirements and Information for the Certification of Radio Apparatus*.[31] These limits are reproduced below for reference.

Table 6.3: General Field Strength Limits for Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

In the proposed U.K. rules, there are provisions for white space devices to operate with various out-of-band emission masks. The U.K. databases would provide white space devices with different lists of available frequencies and/or require those white space devices to operate at a reduced power level depending on their out-of-band performance. This is intended to ensure a constant level of interference protection for adjacent band systems.

6-13 Comments are sought on the above proposals. Should provisions for flexible out-of-band masks, similar to the U.K. rules, also be included? Is there a need for additional measures on adjacent channels to protect systems operating at the edge of the TV bands?

6.8 Overall Conclusions on White Space Devices

The preceding text discusses how white space devices might operate in Canada and what measures of protection could be implemented to protect other users of the band from interference.

6-14 On balance, do the potential benefits of permitting licence-exempt white space devices to operate in Canada outweigh their potential risks to other services?

[30] For example, an attenuation of 72.8 dB below the highest average power in the channel in which the white space device is operating based on a 6 MHz emission bandwidth for the desired channel of operation and an emission bandwidth of 100 kHz for the adjacent channel.

[31] See http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08449.html.

7. Changes to the Canadian Table of Frequency Allocations

Frequency allocations are an important first step in developing spectrum utilization policies that foster the implementation of new radiocommunication services. Modifications to the *Canadian Table of Frequency Allocations* (herein referred to as the Canadian Table) are intended to reflect the public interest by introducing new wireless services that benefit Canadians and respond to marketplace demands.

In previous sections of this consultation, several points of discussion are presented in regard to the licensing of LPA, the potential introduction of licence-exempt white space devices, and the continued use of RRBS. Depending on the outcome of the consultation, the Department may pursue these options in accordance with public interest and there may be a need to modify the Canadian Table.

Currently, the Canadian Table includes primary allocations for the broadcasting service in all of the bands used for TV broadcasting.

If provisions are made to retain the application of RRBS in the bands 470-608 MHz and 614-698 MHz, a new Canadian footnote would be added to the Canadian Table to reflect this.

Similarly, no specific entry in the Canadian Table was made for LPA, but licensing is carried out in accordance with the procedures described in CPC-2-1-11, *Low-power Licensed Radio Apparatus*. If Industry Canada retains licensing of LPA, a new Canadian footnote will be added to the Canadian Table to make provision for licensed low-power apparatus in the bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz. If the Department introduces licence-exempt devices, such as potential white space devices, there is no need for an allocation in the Canadian Table.

Industry Canada is therefore considering the following changes to the Canadian Table:

Table 7.1: Proposed Changes to the Canadian Table of Frequency Allocations

54-72	BROADCASTING ADD CYY
…	
76-108	BROADCASTING ADD CYY
…	
174-216	BROADCASTING ADD CYY
…	
470-608	BROADCASTING 5.293 5.297 C24 ADD CYY, CYZ
608-614	RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)
614-698	BROADCASTING 5.293 C24 ADD CYY, CYZ

ADD CYY The bands 52-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz are also available for use by licensed low-power apparatus.

ADD CYZ The bands 512-608 MHz and 614-698 MHz are also available for use by remote rural broadband systems (RRBS).

7-1 Comments are sought on these proposed modifications to the *Canadian Table of Frequency Allocations*.

8. Cross-border Impact

It is anticipated that white space devices will become available on the U.S. market starting in late 2011 or early 2012, although their use may not become widespread for several years.

Currently, the use of the broadcasting spectrum is covered by the *Agreement Between the Government of Canada and the Government of the United States of America Relating to the TV Broadcasting Service and the Associated Working Arrangement*, the *Letter of Understanding (LOU)*, which covers the areas within 400 km of the border, and the *Interim Arrangement Between Canada and the United States Concerning Digital Television (DTV)*. The LOU does not deal with non-broadcasting system use of the broadcast spectrum. Regardless, such use within 400 km of the border area must be on a no-protection, no-interference basis with respect to broadcast services in both Canada and the United States. As well, Industry Canada currently has a mandatory 121 km border distance within which RRBS stations are not permitted to operate until such time as a new bilateral Agreement is reached.

In its Second Memorandum Opinion and Order, the U.S. FCC states that it will "…protect Canadian and Mexican stations in the TV bands database as protected services within those countries…thereby ensuring that stations in those countries will be protected to the same level as stations in the U.S."[32] The FCC's use of geo-location, combined with TV band databases, is expected to limit operation of these devices to the United States until such time as other regulators in other countries establish their own databases and associated rules. As well, station information for licensed Canadian systems using the TV broadcasting bands will be recorded in the U.S. TV band databases and, as a result, offered protection from potential cross-border interference.

Industry Canada believes that these measures will be sufficient to protect existing licensees in Canada and proposes to apply the same measures to protect viewers of U.S. TV broadcast stations near the Canada-United States border.

8-1 Comments are sought on whether the measures of the FCC to protect Canadian licensees are adequate and whether Industry Canada's proposed measures are adequate to protect U.S. licensees, including TV broadcasters. Provide supporting arguments for your response.

9. Next Steps

Following the receipt of comments to this consultation, Industry Canada will issue a spectrum policy containing decisions on the issues raised in this paper. A further consultation on other aspects of related issues may also be required depending on the comments received.

Industry Canada will subsequently develop any required technical documents, including new or revised Standard Radio Systems Plans and Radio Standards Specifications related to LPA, RRBS and/or white

[32] See FCC 10-174, which is available at http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0923/FCC-10-174A1.pdf.

space devices. Such documents will be drafted in consultation with the Radio Advisory Board of Canada. Note that the policy proposals in this paper or resulting decisions will take effect only once the above-referenced technical documentation is completed.

10. Submitting Comments

Respondents are requested to provide their comments in electronic format (WordPerfect, Microsoft Word or Adobe PDF) to the following e-mail address: Spectrum.Engineering@ic.gc.ca, along with a note specifying the software, version number and operating system used.

In addition, respondents are asked to number their paragraphs for ease of referencing. Submissions should also include an executive summary, using a standardized report format (maximum 5 pages, double-spaced, in 12-point font).

Written submissions should be addressed to the Manager, Fixed Wireless Planning, DGEPS, Industry Canada, 300 Slater Street, 19th Floor, Ottawa, Ontario K1A 0C8.

All submissions should cite the *Canada Gazette*, Part I, the publication date, the title and the notice reference number (SMSE-0012-10). Parties should submit their comments no later than November 4, 2011, to ensure consideration. Soon after the close of the comment period, all comments received will be posted on Industry Canada's Spectrum Management and Telecommunications website at http://www.ic.gc.ca/spectrum.

Industry Canada will also provide interested parties with the opportunity to reply to comments from other parties. Reply comments will be accepted until December 2, 2011.

Following the initial comment period, Industry Canada may, at its discretion, request additional information if needed to clarify significant positions or new proposals. In such a case, the reply comment deadline would be extended.

11. Obtaining Copies

All spectrum-related documents referred to in this paper are available on the Spectrum Management and Telecommunications website at www.ic.gc.ca/spectrum.

For further information concerning the process outlined in this document or related matters, contact:

Manager, Fixed Wireless Planning
Engineering, Planning and Standard Branch
Industry Canada
300 Slater Street, 19th Floor
Ottawa, Ontario K1A 0C8
Telephone: 613-990-4792
Fax: 613-952-5108
E-mail: Spectrum.Engineering@ic.gc.ca

_____

Marc Dupuis
Director General,
Engineering, Planning and Standards Branch

Key words: TV white space devices, white space, unused TV broadcast spectrum, TV white space databases, low-power apparatus (LPA), wireless microphones, remote rural broadband systems (RRBS)

EDRMS:

221080 (E), 243490 (F)

Responsible Officer:
Michael Christensen
Engineering, Planning and Standards Branch | Direction générale du génie, de la planification et des normes
Spectrum, Information Technologies and Telecommunications Sector | Secteur du Spectre, des technologies de l'information et des télécommunications
Industry Canada | Industrie Canada
300 Slater Street, Ottawa ON K1A 0C8 | 300, rue Slater, Ottawa ON K1A 0C8
Michael.Christensen@ic.gc.ca
Telephone | Téléphone 613-990-4792
Facsimile | Télécopieur 613-952-5108
Teletypewriter | Téléimprimeur 1-866-694-8389
Government of Canada | Gouvernement du Canada

RSS Feed: Yes